Remarks

Claims 1-18 are pending in this application and stand rejected. Claims 1, 7 and 13 are amended herein.

Response to Rejection Under 35 USC §101

Claims 1-12 are rejected under 35 USC 101 as not falling within one of the four statutory categories of invention. This rejection is overcome in view of the amended claims.

Claims 1-6 were rejected for not specifying "any physical components for carrying out each of the steps described." *See* Examiner's Answer, page 3. Claim 1 has been amended to associate the method steps with a physical component. Specifically, amended claim 1 now recites "an image database" "a motion analysis block executed by a processor and "a look-ahead detector executed by the processor." Support for this amendment is found throughout the specification, for example at ¶¶ [0025]-[0029] and FIGS. 1 and 2. Accordingly, claims 1-6 now specify a physical component for carrying out the method steps and now recite statutory subject matter. Hence, reconsideration and withdrawal of their rejection is respectfully requested.

Claims 7-12 were rejected for not specifying physical components for carrying out the described operations. *See* Examiner's Answer, page 4. Claim 7 has been amended to now recite "a processor" and "a computer readable storage medium." Thus, claim 7 now recites physical components for carrying out the described operations, meeting the statutory requirements of 35 USC § 101. Support for this amendment is found throughout the specification, for example at ¶¶ [0028]-[0030] and FIG. 2. Therefore, claims 7-12 now meet the requirements of 35 USC § 101, so reconsideration and withdrawal of their rejection is respectfully requested.

Response to Rejection Under 35 USC §103(a)

The Examiner rejected claims 1-18 under 35 USC § 103(a) as unpatentable over PCT Application No. US97/08266 to Chang et al. ("Chang") in view of U.S. Patent No. 6,670,963 to Osberger. ("Osberger"). This rejection is respectfully overcome in view of the amended claims.

As amended, representative claim 1 recites:

> A method of detecting at least one of a pan and a zoom in a video sequence, comprising:
>
> selecting a set of frames from a video sequence;
>
> determining a set of motion vectors for each frame in the set of frames;
>
> determining a motion angle for each motion vector;
>
> identifying at least two largest regions in each frame using a look-ahead detector executed by the processor, wherein the first largest region includes motion vectors with substantially similar motion angles and occupies a largest number of pixels in a frame and the second largest region includes motion vectors with substantially similar motion angles and occupies a second largest number of pixels in a frame;
>
> determining percentages of each frame covered by each of the at least two largest regions using the look-ahead detector;
>
> determining a statistical measure of the motion angles for at least one of the two largest regions; and
>
> comparing the percentages and statistical measure to threshold values to identify at least one of a pan and a zoom in the video sequence.

The claimed method detects the presence of a pan or a zoom in a video sequence. Initially a set of frames are selected from the video sequence and a set of motion vectors are determined for each frame in the set. A motion angle describing motion vector orientation is then determined for each motion vector. At least two largest regions in each frame, the first largest region including motion vectors with substantially similar motion angles and occupying a largest number of pixels in a frame and the second largest region including motion vectors with substantially similar motion angles and occupying a second largest number of pixels in a frame having motion vectors with substantially similar motion angles are then identified. The percentage of each frame covered by each of the at least two largest regions is then determined. A statistical measure of the motion angles for at least one of the identified two largest regions is

computed and compared to threshold values to identify a pan or a zoom. Support for the amendments to the independent claims is fround throughout the specification, for example at ¶¶ [0033]-[0036].

Thus, the claimed method detects a pan or a zoom by identifying the two largest regions of each frame in a video sequence having substantially similar motion vector orientation and occupying the largest and second largest number of pixels in a frame. Motion angles are computed for each motion vector and the motion angles are used to identify the regions that have substantially similar motion vector orientation. By identifying the two largest regions of each frame having a substantially similar motion vector orientation and occupying the largest number of pixels and second largest number of pixels in a frame, the claimed method allows for pan or zoom detection without computing global motion parameters (i.e., computing motion where most of the image points are uniformly displaced). Further, determining motion angles for each motion vector allows for rapid identification of frame regions having substantially similar motion vector orientation by evaluating the similarity of the motion angles. Determining a statistical measure for one of the largest frame regions, rather than the entire frame, reduces the computation necessary to detect a pan or a zoom in the frame, beneficially improving the efficiency of pan or zoom detection.

As amended, representative claim 1 recites, in part "identifying at least two largest regions in each frame using a look-ahead detector executed by the processor, wherein the first largest region includes motion vectors with substantially similar motion angles and occupies a largest number of pixels in a frame and the second largest region includes motion vectors with substantially similar motion angles and occupies a second largest number of pixels in a frame"

and "determining percentages of each frame covered by the at least two largest regions." Independent claims 7 and 13, as amended, recite similar elements.

Chang identifies areas of a frame having motion vectors different than non-moving areas of the frame (Chang, page 17, lines 4-6). To identify the moving portions of the frame, Chang compares motion vectors to a predetermined threshold value, eliminating areas of the frame with motion vectors less than the predetermined threshold value (Chang, page 17, lines 7-11). The identified portions of the frame with motion vectors exceeding the predetermined threshold value are analyzed using a linear transformation and a translation to more particularly identify moving and non-moving regions of a frame. However, this determination accounts for the magnitude of the motion vectors associated with a portion of the frame and is unrelated to the number of pixels occupied by the identified regions. In contrast, the claimed invention identifies "at least two largest regions in each frame" where the "first largest region includes motion vectors with substantially similar motion angles and occupies a largest number of pixels in a frame and the second largest region includes motion vectors with substantially similar motion angles and occupies a second largest number of pixels in a frame" to identify the largest areas within a frame having substantially similar motion vectors. Chang does disclose, or even suggest, identifying the largest and second largest number of pixels in a frame that include substantially similar motion angles.

At most, Chang compares a number of contiguous blocks associated with a motion vector to a threshold value to improve detection accuracy (Chang, page 17, lines 10-13). However, this comparison merely prevents false detection of small objects, and does not identify "at least two largest regions in each frame" where the "first largest region includes motion vectors with substantially similar motion angles and occupies a largest number of pixels in a frame and the

second largest region includes motion vectors with substantially similar motion angles and occupies a second largest number of pixels in a frame," as claimed. Rather than identify regions having substantially similar motion angles and occupying the largest or second largest number of pixels in a frame, Chang identifies all regions in a frame having any motion vector exceeding the threshold value and associated with more than a minimum number of contiguous blocks. This merely places a minimum on the size of the regions identified, so any region exceeding this minimum value is identified, rather than the regions occupying the largest number of pixels and the second largest number of pixels in a frame.

Further, as Chang does not identify "at least two largest regions in each frame having motion vectors with substantially similar motion angles," Chang cannot determine "percentages of each frame covered by each of the at least two largest regions," as recited in the independent claims. Because Chang detects all regions in a frame including motion vectors exceeding the predetermined threshold value, there is no determination of the "percentages of each frame covered by each of the at least two largest regions," but merely an identification of all portions of the frame satisfying minimum requirements. Further, the Examiner admits that Chang does not explicitly disclose determining percentages of each frame covered by the at least two largest regions. *See* Final Office Action dated May 2, 2008, page 4.

Osberger fails to remedy the deficient disclosure of Chang. Rather, Osberger discloses a segmentation algorithm dividing a video frame into a plurality of regions based on color and luminance (Osberger, Abstract). The segmentation algorithm processes both a current frame and a previous frame to produce motion vectors for the current frame (Osberger, 2:33-37). However, Osberger examines motion vectors associated with the complete current frame and the complete previous frame to generate an importance map for the current frame (Osberger, 3:23-30). There

is no disclosure or suggestion in Osberger of "identifying at least two largest regions in each frame using a look-ahead detector executed by the processor, wherein the first largest region includes motion vectors with substantially similar motion angles and occupies a largest number of pixels in a frame and the second largest region includes motion vectors with substantially similar motion angles and occupies a second largest number of pixels in a frame" and "determining percentages of each frame covered by the at least two largest regions," as claimed.

Osberger merely examines a specified percentile of the camera motion compensated vector map to estimate motion in a current frame. For example, Osberger examines the 98th percentile of the camera motion compensated vector map and disregards the remaining 2 percent of the motion vectors to determine the amount of overall motion in a complete frame vector map (Osberger, 7:61-64). This estimation does not identify "at least two largest regions in each frame using a look-ahead detector executed by the processor, wherein the first largest region includes motion vectors with substantially similar motion angles and occupies a largest number of pixels in a frame and the second largest region includes motion vectors with substantially similar motion angles and occupies a second largest number of pixels in a frame" or "determine percentages of each frame covered by the at least two largest regions," but merely discounts a portion of the motion vectors in a complete frame during analysis. Like Chang, Osberger does not identify specific regions within a frame having substantially similar motion vectors and occupying "a largest number of pixels in a frame" and "a second largest number of pixels in a frame," but analyzes a frame in its entirety. As Osberger does not identify different regions within the analyzed frame, Osberger also does not determine "percentages of each frame covered by each of the at least two largest regions." The percentile of the compensated motion vector

map analyzed in Osberger is not associated with any region of the frame, much less the two largest regions of the frame, but is a general map of all motion in a complete frame.

Hence, the motion analysis disclosed in Osberger examines individual frames in their entirety and does not identify "at least two largest regions in each frame using a look-ahead detector executed by the processor, wherein the first largest region includes motion vectors with substantially similar motion angles and occupies a largest number of pixels in a frame and the second largest region includes motion vectors with substantially similar motion angles and occupies a second largest number of pixels in a frame" or determine "percentages of each frame covered by the at least two largest regions," as claimed.

While Osberger produces motion vectors for a current frame by processing the current frame and a previous frame, the claimed invention identifies a first largest region in a frame including motion vectors with substantially similar motion angles and a second largest region including includes motion vectors with substantially similar motion angles and occupying a second largest number of pixels in a frame. The percentage of the frame covered by each of the identified largest regions is computed and analyzed to identify a pan or zoom. Rather than determine the percentage of a frame covered by specific regions, Osberger takes "the mth percentile, such as the 98th percentile, of the camera motion compensated motion vector map" to estimate the amount of motion in a scene using a subset of the camera motion compensated motion vector map (Osberger, col. 7, lines 58-64). This motion vector map describes <u>all</u> motion in a complete frame, without identifying distinct regions within the frame, much less regions within the frame having substantially similar motion angles and occupying the largest number of pixels or the second largest number of pixels in the frame (Osberger, col. 8, lines 10-34). The analysis in Osberger of the motion vector map does not determine the percentage of the frame

individually covered by each of the identified largest regions, but merely eliminates a percentile of the motion vectors from the frame as a whole. There is no correlation disclosed in Osberger between the percentile of the compensated motion vector map and individual regions within the frame or the size of specific regions within the compensated motion vector map.

Nothing in Osberger indicates that the disclosed motion vector map or percentile analysis identifies "at least two largest regions in each frame using a look-ahead detector executed by the processor, wherein the first largest region includes motion vectors with substantially similar motion angles and occupies a largest number of pixels in a frame and the second largest region includes motion vectors with substantially similar motion angles and occupies a second largest number of pixels in a frame" and or determines the percentage of a frame covered by each of the two largest regions of the frame having motion vectors with substantially similar motion angles. In contrast to the global analysis of the motion vector map for a complete frame disclosed in Osberger, the claimed invention identifies specific regions within a frame and analyzes the identified regions to determine the presence of a pan or zoom. As part of this analysis, the claimed invention determines the percentage of the frame covered by the two largest regions of the frame having substantially similar motion angles. Merely analyzing a specified percentile of a motion vector map does not determine of the percentages of a frame covered by the largest regions in the frame having motion vectors with substantially similar motion angles, but analyzes a subset of the motion vectors included in a complete frame, regardless of the location of the motion vectors within the frame. Osberger allows for evaluation of the difference in overall motion between two complete frames using a percentile of motion in the frames, but does not determine "percentages of each frame covered by each of the at least two largest regions" having substantially similar motion vectors, as claimed. The determination of an overall percentile of all

motion in a frame does not determine the percentage of a frame covered by specific regions within the frame.

During prosecution of the current application, references have been made to hypothetical cases of frames with moving backgrounds and frames with non-moving backgrounds to support application of Osberger and Chang to the claims. *See* Final Office Action dated May 2, 2008, page 2; Examiner's Answer, pages 8-9. Although a frame having a single moving foreground object and a static background object would have two regions having different motion vectors, the statements in the Final Office Action date May 2, 2008, and the Examiner's Answer overlook claim elements when discussing this hypothetical example, and neither Osberger nor Chang explicitly disclose the hypothetical scenario presented. Furthermore, even if the combination of Chang and Osberger allows differentiation between a static background and one or more moving objects in the foreground, this identification does not identify "at least two largest regions in each frame using a look-ahead detector executed by the processor, wherein the first largest region includes motion vectors with substantially similar motion angles and occupies a largest number of pixels in a frame and the second largest region includes motion vectors with substantially similar motion angles and occupies a second largest number of pixels in a frame" or determine "percentages of each frame covered by each of the at least two largest regions," but identifies any region in a frame having different motion vectors than the frame's background.

Differentiation between moving object and static background does not determine the percentage of each frame covered by the moving object or the static background, but merely indicates a difference in motion vectors between one or more moving objects and the background. This identification of moving objects is independent of the pixels occupied by the moving object or the background, but is based on differences in the motion vectors of different

portions of the frame. By determining the at least two largest regions in each frame and determining the percentage of the frame covered by each of the at least two largest regions, the claimed invention reduces the computation necessary to detect a pan or a zoom in a video sequence by using the at least two largest regions to represent motion within the frame. The disclosures of Chang and Osberger do not address the percentage of a frame covered by any identified moving objects, but analyze movement in the frame as a whole based on differences between motion vectors.

Additionally, in the Examiner's Answer, it is alleged that "the Applicant's own specification shows that the percentages of the largest regions are summed, and the sum is compared to a threshold…just as described in Osberger." Examiner's Answer, page 10. However, the independent claims recite "determining percentages of each frame covered by each of the at least two largest regions," which is not disclosed in Osberger or Chang. The subsequent use of these percentages is not relevant to whether or not the cited references disclose this claimed element. Although the specification provides an example embodiment of the claimed invention where the determined percentages are summed, this is not recited in the independent claims, which specifically include the element of "determining percentages of each frame covered by the at least two largest regions." This claim element is not disclosed in Chang or Osberger.

Thus, the cited references, taken alone or in combination, do not disclose or teach the claimed invention. Therefore, claim 1 is patentable over the cited references and withdrawal of the rejection is respectfully requested.

As amended, independent claims 7 and 13 similarly recite "identifying at least two largest regions in each frame using a look-ahead detector executed by the processor, wherein the first

largest region includes motion vectors with substantially similar motion angles and occupies a largest number of pixels in a frame and the second largest region includes motion vectors with substantially similar motion angles and occupies a second largest number of pixels in a frame" and "determining percentages of each frame covered by the at least two largest regions." Therefore, amended claims 7 and 13 are patentable over the cited references, both alone and in combination, for at least the same reasons discussed above with respect to claim 1.

In addition to reciting their own patentable features, claims 2-6, 8-12 and 14-18 variously depend from patentable base claims 1, 7 and 13. Accordingly each of dependent claims 2-6, 8-12 and 14-18 are also patentable.

The Examiner also rejected claim 16 as unpatentable over Chang and Osberger in view of Official Notice. However, the Official Notice relied upon by the Examiner does not overcome the deficiencies of Chang and Osberger. The Official Notice merely indicates that polar coordinates are a form of mathematical representation. However, this Official Notice does not disclose "identifying at least two largest regions in each frame using a look-ahead detector executed by the processor, wherein the first largest region includes motion vectors with substantially similar motion angles and occupies a largest number of pixels in a frame and the second largest region includes motion vectors with substantially similar motion angles and occupies a second largest number of pixels in a frame" and "determining percentages of each frame covered by the at least two largest regions," as claimed. Therefore, the combination of Chang, Osberger and Official Notice fails to disclose the subject matter of claim 16.

Thus, claim 16 is patentably distinguishable over the cited references, both alone and in combination and withdrawal of the rejection is respectfully requested.

Conclusion

Should the Examiner wish to discuss the above remarks, or if the Examiner believes that for any reason direct contact with Applicants' representative would help to advance the prosecution of this case to allowance, the Examiner is invited to telephone the undersigned at the number given below.

Respectfully submitted,
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